

WHAT IS CLAIMED IS:

1. A transreflective display device comprising:
 - a first OLED device comprising a conventional OLED device and characterized as emitting light of a first predetermined bandwidth;
 - a second OLED device comprising a transparent OLED device and characterized as emitting light of a second predetermined bandwidth, the second OLED device positioned adjacent an emitting surface of the first OLED device and
 - a light modulating element positioned adjacent an emitting surface of the second OLED device.

wherein at least one of the OLED devices is fabricated on a light scattering substrate element, the light scattering substrate element having at least a roughened surface and wherein the first and second bandwidths are different.
2. The device of claim 1 wherein the first and second bandwidths are emitted in combination with one another in timed sequence.
3. The device of claim 2 wherein the first OLED device is fabricated on the roughened surface of the light scattering substrate element, the first OLED device having a reflective electrode positioned such that light reflected from a reflective surface of the reflective electrode is transmitted through the emitting surface of second OLED device.
4. The device of claim 3 further including a third OLED device comprising a transparent OLED device characterized as emitting light in a third predetermined bandwidth, the third OLED device positioned between the emitting surface of the first OLED device and the second OLED device wherein the first, second and third bandwidths are emitted in combination with one another in timed sequence.
5. The device of claim 1 further including an encapsulant.
6. The device of claim 1 wherein the light modulating element is a liquid crystal display.
7. The device of claim 4, wherein the first, second and third OLEDs and the light

modulating element are fabricated to form a hermetically sealed package.

8. A transflective display device comprising a light modulating element positioned adjacent to an emitting surface of an OLED backlight, said OLED backlight comprising:

a first OLED fabricated on a light scattering substrate element, the light scattering substrate element having at least one surface with a predetermined surface roughness, the first OLED comprising

a first conductive layer disposed over the light scattering substrate element;

a first organic layer disposed over the first conductive layer, the first organic layer comprising an emissive material that emits light in a first bandwidth;

a second conductive layer disposed over the organic layer

wherein one of the first and second conductive layers is a reflective layer and the other is a transmissive layer;

a second OLED positioned adjacent an emitting surface of the first OLED, the second OLED comprising

a third conductive layer;

a second organic layer disposed over the third conductive layer, the second organic layer comprising an emissive material that emits light in a second bandwidth different from the first bandwidth;

a fourth conductive layer disposed over the organic layer

wherein the third conductive layer and the fourth conductive layer comprise transmissive layers.

9. The device of claim 8 wherein the first and second bandwidths are emitted in combination in timed sequence.

10. The device of claim 8 further comprising a third OLED positioned adjacent an

emitting surface of the second OLED, the third OLED comprising
a fifth conductive layer
a third organic layer disposed over the fifth conductive layer, the
third organic layer comprising an emissive material that emits light
in a third bandwidth different from the first and the second
bandwidths; and,
a sixth conductive layer disposed over the third organic layer
wherein the fifth conductive layer and the sixth conductive layer comprise
transmissive layers.

11. The device of claim 10 wherein the first, second and third bandwidths are emitted in combination in timed sequence
12. The device of claim 11 wherein the first, second and third bandwidths are red, green and blue respectively.
13. The device of claim 8 wherein the light modulating element and the OLED backlight are fabricated to form a hermetically sealed package.
14. The device of claim 8 wherein at least one of the transmissive conductive layers comprises indium tin oxide (ITO).
15. The device of claim 14 wherein the at least one of the transmissive conductive layers comprises a magnesium (Mg) material and a lithium silver (Li--Ag) material.
- 16.. The device of claim 8 wherein the reflective conductive layer comprises an opaque metal electrode layer.
17. The device of claim 8 wherein the predetermined surface roughness is characterized as S_rSm: 3 λ and Δ:4~30.
18. The device of claim 8 wherein the first OLED is deposited on the surface of the light scattering substrate element that has the predetermined surface roughness.
19. A light emitting display device comprising

- a light modulating element
 - a first electrode comprising a layer of transmissive material disposed over the light modulating element;
 - a second electrode comprising a layer of transmissive material disposed over the first electrode,
 - a third electrode comprising a layer of reflective material disposed over the second electrode,
 - a first organic layer comprising an emissive material disposed between the first electrode and the third electrode;
 - a first substrate element, said first substrate element disposed between the first organic layer and the light modulating element, the first substrate element having at least one surface with a predetermined surface roughness.
20. The device of claim 19 wherein the predetermined surface roughness enhances light outcoupling of light emitted from the emissive material in the direction of the light modulating element.
21. The device of claim 20, wherein the surface having the predetermined surface roughness faces the third electrode.
22. The device of claim 21 wherein the third electrode has a reflective surface with a surface roughness profile corresponding to the predetermined surface roughness.
23. The device of claim 19 further including a second organic layer comprising an emissive material, wherein the first organic layer is disposed between the first electrode and the second electrode and the second organic layer is disposed between the second electrode and the third electrode.
24. The device of claim 23, wherein the first and second organic layers emit light of a wavelength different from one another.
25. The device of claim 23, further comprising a fourth electrode disposed between the second organic layer and the third electrode, the fourth electrode comprising a layer of transmissive material.

26. The device of claim 25, further comprising a third organic layer comprising an emissive material disposed between the fourth electrode and the third electrode.
27. The device of claim 26, wherein the first, second and third organic layers each emit a different wavelength of light from one another.
28. The device of claim 27, wherein the different wavelengths are predetermined first, second and third wavelengths capable of producing full color when emitted in combination with one another.
29. The device of claim 28 wherein the first, second and third wavelengths are emitted in combination with one another in timed sequence.
30. The device of claim 25, wherein the first, second and third predetermined wavelengths are blue, green and red respectively.
31. The device of claim 19, further comprising a second substrate disposed between the first electrode and the light modulating element.
32. The device of claim 31, further comprising a third substrate disposed between the third electrode and the second substrate.
33. The device of claim 26, wherein the distance between the reflective electrode and the light modulating element is less than about 2000 microns.
34. The device of claim 32, wherein the distance between the reflective electrode and the light modulating element is less than about 5000 microns.
35. A transreflective display device comprising a light modulating element and an OLED backlight, said OLED backlight comprising a:
 - a substrate having an upper surface and a lower surface, at least one of the upper surface and the lower surface having a predetermined surface roughness;
 - a first electrode comprising a reflective material disposed over the substrate ;
 - a second electrode disposed over the first electrode, the second electrode comprising a transmissive material;
 - a first organic layer including an emissive material disposed between the first electrode and the second electrode;

a third electrode disposed over the second electrode, the third electrode comprising a transmissive material;

a second organic layer including an emissive material disposed between the second electrode and the third electrode;

wherein the first electrode is the only significantly reflective layer in the device.

36. The device of claim 35 , wherein the first organic layer comprises a first emissive material capable of emitting a first spectra of light; and the second organic layer comprises a second emissive material capable of emitting a second spectra of light different from the first.

37. The transflective device of claim 36 further including

a fourth electrode disposed over the third electrode, the fourth electrode comprising a transmissive material and

a third organic layer including a third emissive material disposed between the third electrode and the fourth electrode;

wherein the third emissive material is capable of emitting a third spectra of light different from the first and the second spectra of light.

38. The transflective device of claim 37, wherein the first emissive material is included in a first organic light emitting diode , the second emissive material is included in a second organic light emitting diode, and the third emissive material is included in a third organic light emitting diode wherein said first, second and third organic light emitting diodes comprise separate OLED devices.

39. The transflective device of claim 37, wherein the first, second and third emissive materials are included in a single OLED device.

40. The transflective device of claim 39, wherein the single OLED device comprises a stacked light emitting diode.

41. The transflective device of claim 35 wherein the OLED backlight is encapsulated.

42. The transflective device of claim 38 wherein the OLED backlight is encapsulated.

43. The transflective device of claim 35 wherein the OLED backlight and the light modulating element are fabricated to form a hermetically sealed device.